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Halophila decipiens (*Hydrocharitaceae*), a new seagrass record for Sabah

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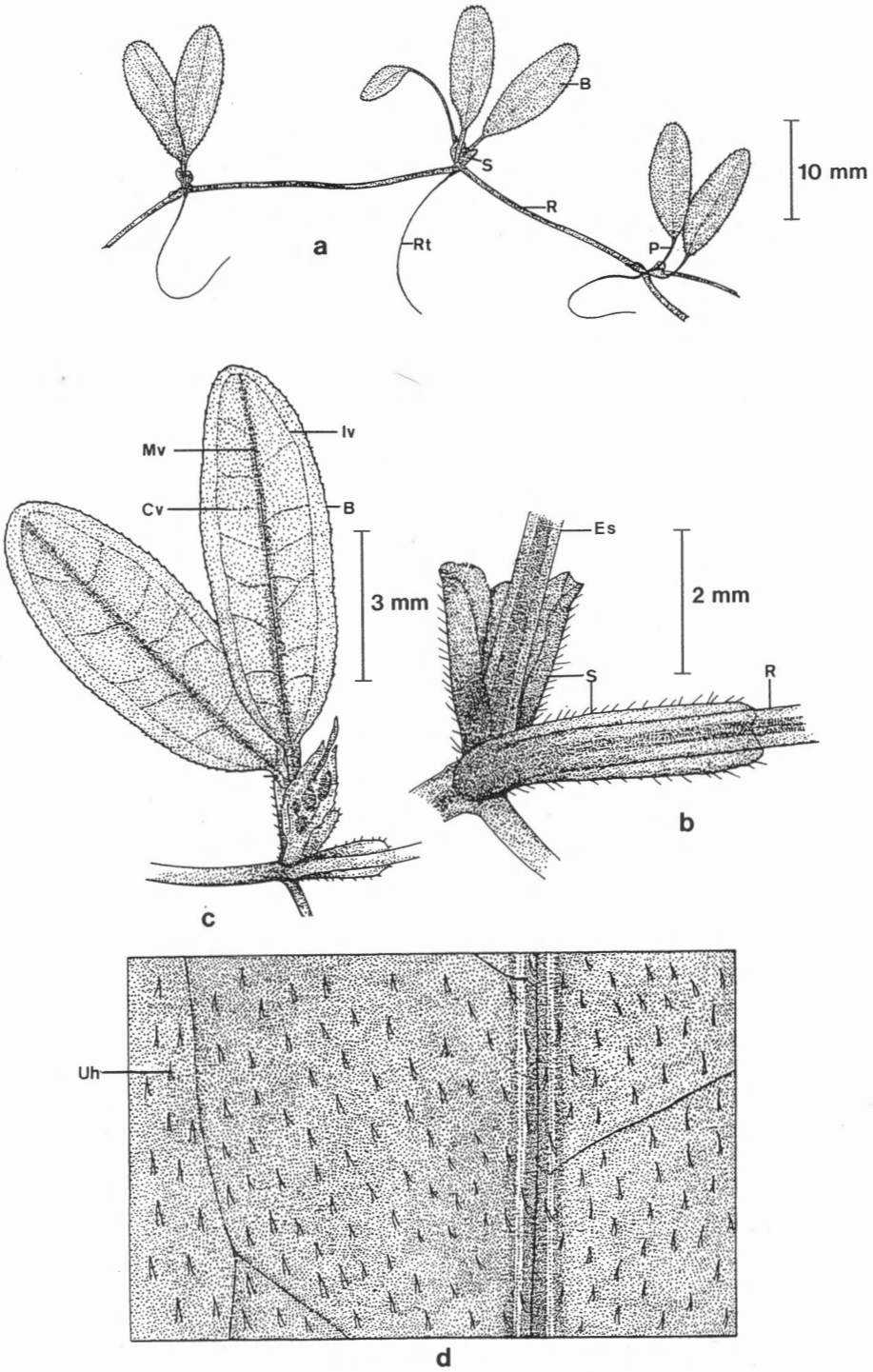
Summary. *Halophila decipiens* Ostenf., previously recorded in Malaysia only from the west coast of Peninsular Malaysia, is now known also from the north-east coast of Pulau Sulug in the Tunku Abdul Rahman Park, Sabah. The distribution, ecology and morphological characters of both vegetative and reproductive structures are discussed. The presence of this seagrass at Pulau Sulug increases the number of seagrass species known in Sabah waters to ten. The presence of four styles in female flowers of *H. decipiens*, recorded for the first time, appears not to be uncommon.

Nine species of seagrasses in six genera are known on Sabah coasts: *Enhalus acoroides* (L.f.) Royle, *Halophila ovalis* (R. Br.) Hook. f., *Halophila minor* (Zoll.) Den Hartog, *Halodule uninervis* (Forssk.) Aschers., *Halodule pinifolia* (Miki) Den Hartog, *Cymodocea*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rotundata Ehrenb. & Hempr. ex Aschers., *Cymodocea serrulata* (R. Br.) Aschers. & Magnus, *Thalassia hemprichii* (Ehrenb.) Aschers. and *Syringodium isoetifolium* (Aschers.) Dandy.

In Sabah waters, *Halophila ovalis* is a common seagrass whereas *H. minor* is considered rare (Ismail 1993). In Peninsular Malaysia, *Halophila* is represented by five species: *H. beccarii* Aschers., *H. minor*, *H. ovalis*, *H. spinulosa* (R. Br.) Aschers. and *H. decipiens* Ostenf. Of these, *H. decipiens* was only recently reported for Malaysia (Japar *et al.* 1995). However, male and female reproductive structures have not been described for the Malaysian material.

During an extensive survey of seagrasses in waters around the Tunku Abdul Rahman Park in Sabah, a monospecific meadow of *H. decipiens* was found at Pulau Sulug, including flowering material with both male and female flowers. The occurrence of this species has not been noted in previous surveys in Sabah (Ismail 1993).

Sampling site and material studied

Halophila decipiens specimens were collected in May 1996 at depths of 8 to 18 m, off the north-east coast of Pulau Sulug (5°57'37.8"N 115°59'56"E), an island in the Tunku Abdul Rahman Park of Sabah.

Material was processed for herbarium specimens as described by Menez *et al.* (1983) and some was preserved in 4% formalin in saline water for further examination. The collecting data is as follows: Specimen Catalogue No: 01-66: Seagrass Flora of Sabah. *Halophila decipiens* Ostenfeld, Pulau Sulug, Tunku Abdul Rahman Park, Sabah. 27 May 1996. All specimens are currently with the first author.

Morphology of *Halophila decipiens*

Plant monoecious, with creeping fragile narrow rhizome, 0.7–0.9 mm thick; internodes 10–30 mm long, usually one unbranched root with numerous root hairs present below each erect shoot (Fig. 1a). Erect stem arising from each node short, up to 4.2 mm long, bearing a pair of leaves; the erect stem and the immediate rhizome enveloped by a pair of

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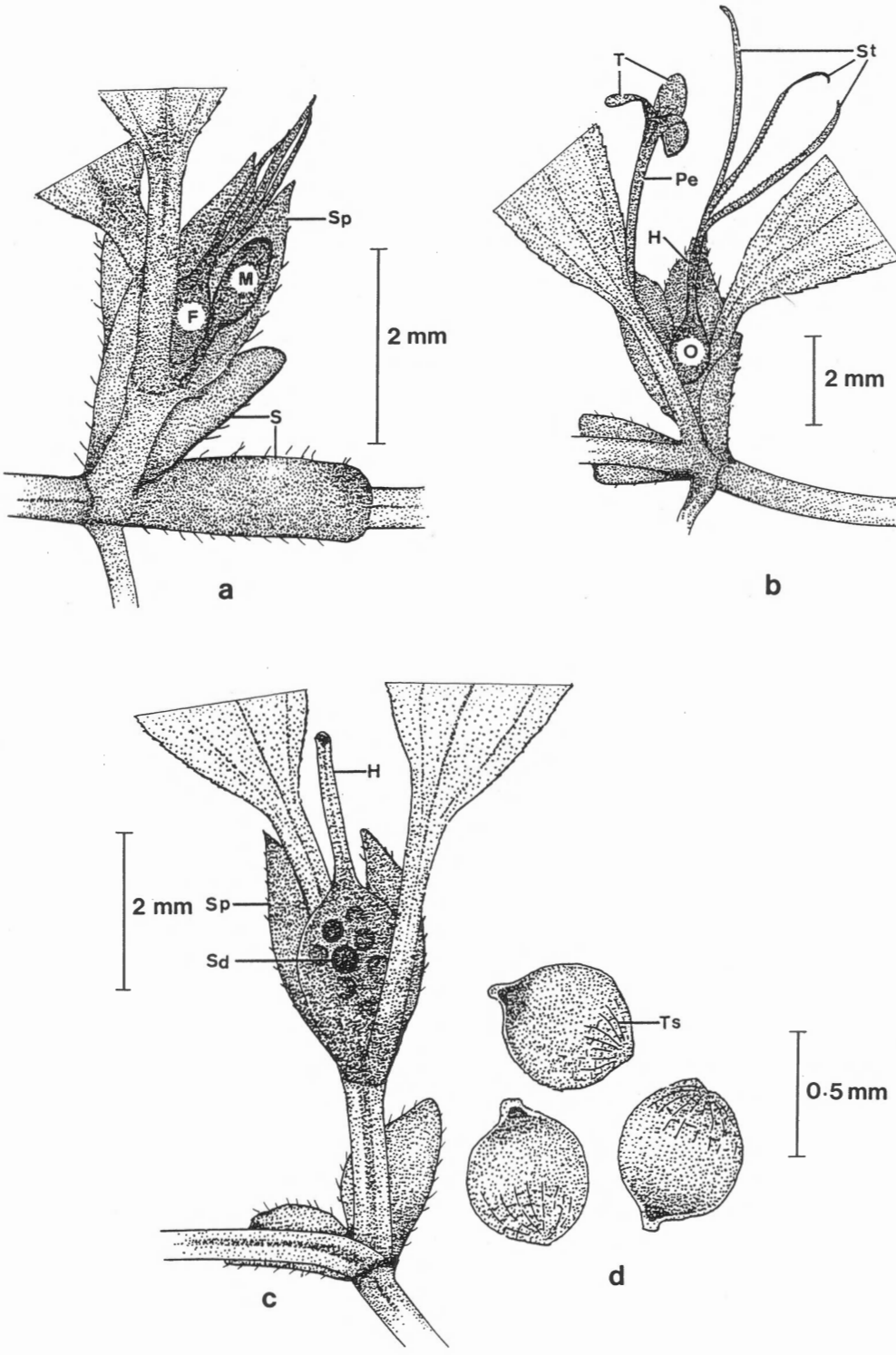
Fig. 1. *(opposite) Halophila decipiens* from Pulau Sulug. **a**, habit (B–leaf blade; P–petiole; R–rhizome; Rt–root; S–scales). **b**, a pair of transparent scales (S) with short stiff hairs enveloping an erect stem (Es) and a rhizome (R). **c**, leaf blade (B) with finely serrated margins, showing mid-vein (Mv), cross-veins (Cv) and intramarginal vein (Iv). **d**, detail of leaf surface with short, stiff unicellular hairs (Uh).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transparent scales, 1.5–3.7 mm long, obovate, keeled with short stiff hairs on the margin and the outside (Fig. 1b). Leaf blades pale green in colour, distinctly elliptic, obtuse at the apex, margin finely serrated, length 7.5–16 mm, width 2.5–5.2 mm; mid-vein conspicuous, united apically with intramarginal veins (Fig. 1c); cross-veins 5–10 pairs, sub-opposite to alternate, occasionally forked; both surfaces with dense, short, stiff unicellular hairs, almost evenly distributed (Fig. 1d); petioles slender, 1–7.3 mm long.

Inflorescence a pair of flowers, one male and one female, or both female, subtended by 2 overlapping spathes; the spathes scarious, transparent, 1.8–3.7 mm long, with finely serrulate margins. Male flower (Fig. 2a): pedicel whitish, rather thick, up to 4.3 mm long; tepals 3, whitish, oblong-elliptic, convex, 0.7–1 mm long; anthers three, fused, 0.5–0.8 mm long. Female flower (Fig. 2a, b): sessile, ovary ovoid, 0.8–2.2 mm long; hypanthium 1–2.5 mm long; styles 3–4, with glandular inner surfaces, of unequal length of 2.7–5.8 mm long. Fruits broadly ellipsoid, 0.9–2.3 mm long, 0.9–1.3 mm wide (Fig. 2c). Seeds 20–30, ellipsoid to spherical, 0.5–0.6 mm in diameter, bluntly beaked at both ends, testa reticulate (Fig. 2d).

The description of *Halophila decipiens* provided here agrees with those given by Den Hartog (1970), De Oliveira *et al.* (1983), Robertson (1984), Parthasarathy *et al.* (1988) and Kuo *et al.* (1995). *Halophila decipiens* is monoecious, with male and female flowers borne in the same axil of the successive lateral erect stem of the same plants (Fig. 2a, b; Fig. 3a–d). This characteristic forms the main criterion for the identification of *H. decipiens*. The recently described *H. capricorni* Larkum (Larkum 1995) is also a monoecious plant and morphologically almost similar to *H. decipiens* but differs in having male and female flowers in different axils of the same plant. *Halophila beccarii* Aschers. and *H. spinulosa* (R. Br.) Aschers. are morphologically different in having more than two leaves and compound leaves, respectively, arising from each rhizome node, whereas *H. ovalis* and *H. minor* are dioecious with male and female flowers on different plants (Den Hartog 1970).

The population *H. decipiens* from Pulau Sulug had male and female flowers at all stages of development: flower buds in their spathes, developing flowers emerging from the spathes and mature open flowers (Fig. 2a, b; Fig. 3a–d). The presence of three styles in female flowers (Fig. 3a, d) has been reported in all previous descriptions of *H. decipiens* (Den Hartog 1970, De Oliveira *et al.*1983, Robertson 1984, Parthasarathy *et al.*1988), including the recent published works by Kuo & Kirkman (1995) and Kuo *et al.* (1995). The occurrence of four styles in the female flowers (Fig. 3b, c) of *H. decipiens* has not been

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Fig. 2. *(opposite)* Flowers of *Halophila decipiens* at various stages of development. **a**, young male flower (M) and female flower (F) from one axil, subtended by spathes (Sp). **b**, mature male flower comprising pedicel (Pe), tepals (T) and anthers (not shown here), and female flower comprising an ovary (O), hypanthium (H) and styles (St). **c**, a fruit with persistent hypanthium (H) and seeds (Sd). **d**, seeds with reticulate testa (Ts).

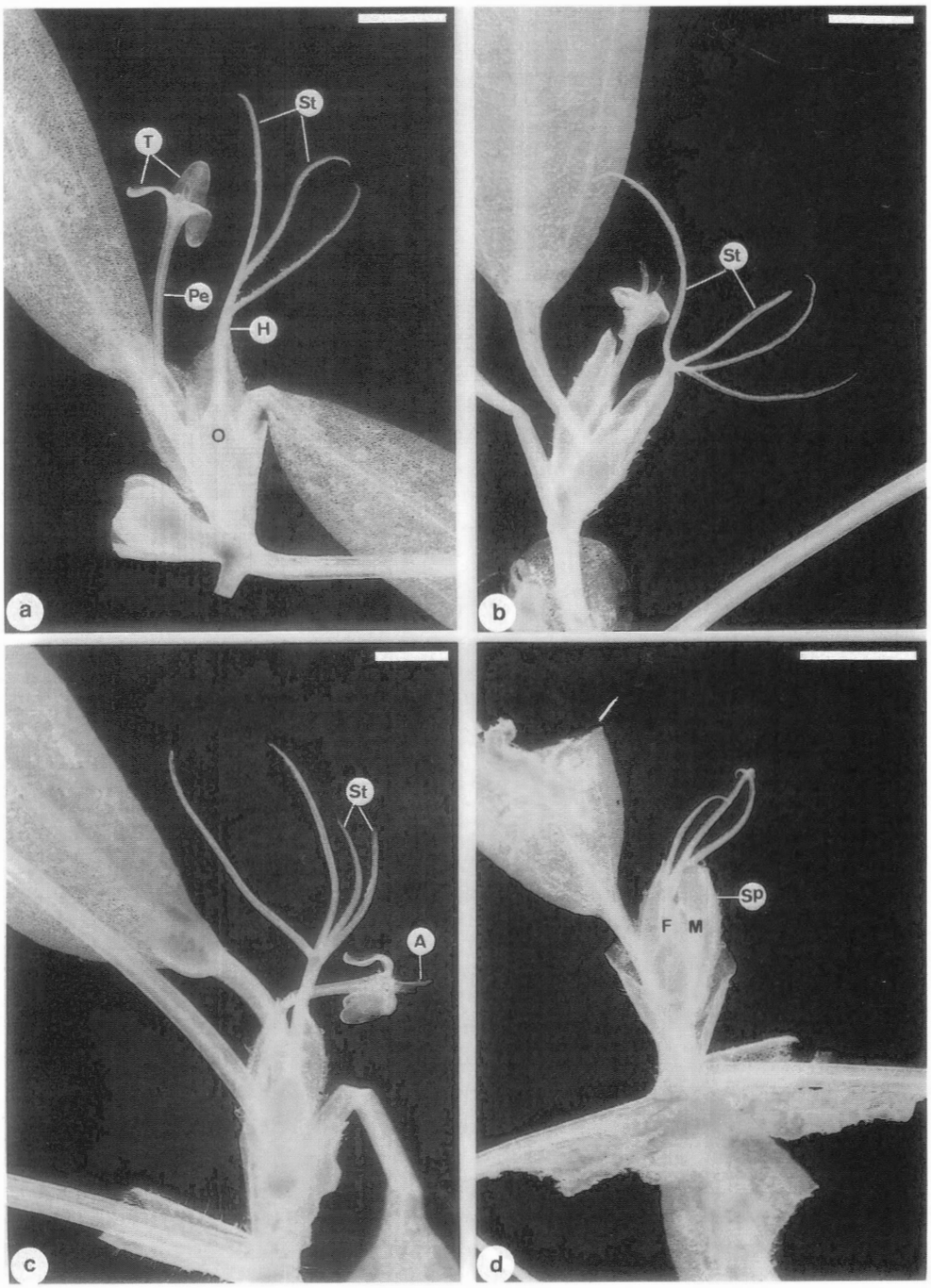

Fig. 3. *Halophila decipiens*. **a**, male flower with pedicel (Pe) and tepals (T); female flower with an ovary (O), hypanthium (H) and 3 styles (St); scale bar 2 mm. **b** and **c**, female flowers with 4 styles (St) and male flowers with anthers (A); scale bar 2 mm and 1 mm, respectively. **d**, female flower (F) maturing earlier than male flower (M) (still in bud stage), subtended by spathes (Sp); scale bar 2 mm.

previously noted (J. Kuo, pers. comm. 1996), although in the population at Pulau Sulug this was not a rare event. Of the 66 plants examined, 13 (20%) had female flowers with four styles.

Flowering biology

Some *Halophila decipiens* inflorescences exhibit protogyny. Enclosed by the spathes, the female flower develops to maturity while the male flower is still in bud condition (Fig. 3d). This has also been observed by Den Hartog (1970) and Parthasarathy *et al.* (1988). We have also observed the occurrence of mature male and female flowers together in the same inflorescence and at successive shoots on the same plant, which suggests that both self-pollination and cross-pollination may occur in *H. decipiens*.

Although at Pulau Sulug abundant flowering and fruiting occurred in May, it was not known over how long this continued. However, from observations made by Kuo & Kirkman (1995) and Kuo *et al.* (1995), flowering and fruiting occurs over 1–2 months at a time, at intervals of some 3–4 months.

Distribution and ecology

Halophila decipiens is widely distributed in the tropical parts of the Indian and Pacific Oceans, and in the Caribbean (Den Hartog 1957, 1970). The Atlantic distribution of this species includes areas in the Canary Islands (Gil-Rodriguez *et al.* 1982), the Gulf of Mexico and various places along the coast of Brazil (Den Hartog 1972, De Oliveira *et al.* 1983). Recently its known distribution has been extended to Okinawa, Japan (Kuo *et al.* 1995) and South-western Australia (Kuo & Kirkman 1995). In south-east Asia, this species has been reported in Thailand, Indonesia (Den Hartog 1970) and in the Philippines (Menez *et al.* 1983, Fortes 1990). In Malaysia, this species has only recently been reported to occur at Teluk Kemang in the state of Negeri Sembilan in Peninsular Malaysia (Japar *et al.* 1995).

At Pulau Sulug in Sabah, *H. decipiens* was found on a gentle slope of soft silty coralline sand at depths between 8 m to 18 m. It grew as scattered pure patches of 15 m in diameter. The green macroalgae *Caulerpa manorensis* Niz. was also found growing among patches of this seagrass. This species has also been reported growing with other seagrasses, *H. spinulosa* and *H. minor* or as pure patches, at depths between 11 m to 23 m, on soft mud with fine sands and silty sediments in the southern Philippines (Menez & Calumpong 1985). At Okinawa Island, it forms sparse, pure stands or grows adjacent to *H. ovalis* at depths between 15 m to 18 m on flat sandy coralline sediment (Kuo *et al.* 1995) and as pure localized stands on clayey sand at depths between 19 m and 23 m (Gil-Rodriguez *et al.* 1982). However, in Tuticorin, Southern India, this species grows with the macroalgae

Caulerpa scalpelliformis R. Br. and *Ulva reticulata* Forssk. on muddy coral sand at a shallow depth of 2 m (Parthasarathy *et al.* 1988). At Teluk Kemang in Peninsular Malaysia, *H. decipiens* grows in small patches on sandy-muddy substratum at a depth of only 1.5 m to 2 m (Japar *et al.* 1995) in association with other seagrasses, *H. ovalis* and *Halodule uninervis*. In general, this seagrass is reported to occur from near shore water surface to a depth of 85 m, depending on the clarity of water (Den Hartog 1970).

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